ENVIRON

MEMORANDUM

Date: September 30, 2008

To: Nat Noland, Indiana Coal Council, Inc.
From: Robin Garibay, ENVIRON International Corp.
Re: Technical Issues of Concern for IDEM's proposed Busseron Creek TMDL

TECHNICAL COMMENTS

The September 3, 2008 draft "Busseron Creek Watershed TMDL Development" (TMDL draft) contains numerous data gaps that contribute to a presentation of a TMDL that does not allow certainty in targets, or if targets are achieved, if the watershed quality would be restored. One of the major gaps in data and information is the support for the presumed relationship of the fish Index of Biotic Integrity (IBI) scores to water quality versus other key components such as water quantity and habitat. The interpretation presented in the TMDL draft is that the fish IBI scores are related to only iron and aluminum concentrations.

The Indiana Coal Council ("ICC") believes that this interpretation is not supported by:

(1) the data presented in the report,
(2) data available on the concentrations of aluminum and iron in Indiana waters, and
(3) data readily available on the aquatic toxicity of aluminum and iron.

The ICC believes that attributing low fish IBI scores to iron and aluminum and ignoring habitat and hydraulics and their role in fish community diversity, fish richness, and fish abundance leads to an unsupported assertion that a reduction in iron and aluminum will result in improved fish IBI scores.

The ICC also would suggest that IDEM designed a flawed study to assess the water quality of the Busseron Creek watershed and identify key issues associated with the impairments and potential sources. Additionally, IDEM did not use the best available science to determine the maximum load and identify the process and methods to achieve the dramatic and substantial reductions needed to achieve the TMDL draft targets.

<u>Aluminum and Iron Water Quality Data versus Fish IBI Scores</u>

There is no concurrent aluminum or iron data with the reported fish IBIs (USGS study); therefore there is no specific data to relate the fish IBI scores to the levels of aluminum and iron. In the TMDL draft, aluminum and iron data are presented from IDEM and IDNR for some, but not all of the sites USGS surveyed. The revised draft TMDL document identifies that the form of the aluminum and iron under consideration is total. It is important to note that in regards to metals associated with biological impairment it is the dissolved form of the metal that is commonly accepted as the bio-available form that impacts biological organisms. Total concentrations often include particulate and unavailable bound forms of the metal that typically have minimal impact on chemical toxicity to fish and other organisms.

In the presentation of the data, the ICC believes that a geometric mean is the best summary statistic to present the central tendency of a database. However, the median and means of the database are also presented.

Interestingly, there were not data for all the sites particularly those with fair and good IBI scores and only one poor IBI score.

The ICC would recommend that IDEM provide the type of summary the ICC has generated from the USGS data, IDEM data, and IDNR data to allow all stakeholders understand the concerns about water quality in Busseron Creek and also understand the limitations of the data and information.

Table 1. Summary of Aluminum Data Compared to Fish IBI Scores

Station #	Fish IBI Score (1)	(2)	Parameter	First Sample Date	Last Sample Date	Total Samples	Geo-mean (ug/L)	Median (ug/L)	Mean (ug/L)
2	12	vp	Aluminum, Total	8/22/2006	12/12/2006	11	5,667	6,750	6,857
5	20	vp	Aluminum, Total	9/19/2006	9/19/2006	2	3,692	3,705	3,705
8	14	vp	Aluminum	7/27/2006	4/23/2008	6	301	359	476
9	12	vp	Aluminum, Total	8/22/2006	12/12/2006	8	359	247	1,151
11	16	vp	Aluminum, Total	8/22/2006	12/12/2006	9	946	1,277	2,697
11	16	vp	Aluminum	7/27/2006	4/23/2008	6	214	100	487
12	18	vp	Aluminum, Total	7/27/2006	4/23/2008	5	1,098	868	17,836
16	28	p	Aluminum, Total	4/13/2004	1/23/2007	8	409	372	491
2	12	vp	Aluminum, Dissolved	8/22/2006	12/12/2006	11	2,356	4,660	4,000
5	20	vp	Aluminum, Dissolved	9/19/2006	9/19/2006	2	47	47	47
9	12	vp	Aluminum, Dissolved	8/22/2006	12/12/2006	9	84	76	90
11	16	vp	Aluminum, Dissolved	8/22/2006	12/12/2006	10	415	67	6,110

Table 2. Summary of Iron Data Compared to Fish IBI Scores

Station #	Fish IBI Score (1)	(2)	Parameter	First Sample Date	Last Sample Date	Total Samples	Geomean (ug/L)	Median (ug/L)	Mean (ug/L)
2	12	vp	Iron, Total	8/22/2006	12/12/2006	11	4,294	4,440	8,107
5	20	vp	Iron, Total	9/19/2006	9/19/2006	2	3,109	3,115	3,115
8	14	vp	Iron	7/27/2006	4/23/2008	6	1,055	668	7,212
9	12	vp	Iron, Total	8/22/2006	12/12/2006	8	875	698	1,189
11	16	vp	Iron, Total	8/22/2006	12/12/2006	9	1,664	3,220	7,131
11	16	vp	Iron	7/27/2006	4/23/2008	6	2,582	4,305	18,297
12	18	vp	Iron, Total	7/27/2006	4/23/2008	5	5,427	3,590	18,156
16	28	p	Iron, Total	4/13/2004	1/23/2007	12	548	560	783
2	12	vp	Iron, Dissolved	8/22/2006	12/12/2006	11	517	573	920
5	20	vp	Iron, Dissolved	9/19/2006	9/19/2006	2	108	108	108
9	12	vp	Iron, Dissolved	8/22/2006	12/12/2006	9	159	175	170
11	16	vp	Iron, Dissolved	8/22/2006	12/12/2006	10	961	1,460	2,260
12	18	vp	Iron, Dissolved	7/27/06	1/23/07	2	4,444	4,545	4,550

(1) Field Work occurred Sept 17 through Sept 19, 2007
(2) vp = very poor; p= poor
(3) Source of data uncertain – found in spreadsheets supplied to ICC by IDEM, but not specific to IDEM or IDNR
(4) Field Duplicate, not two discrete samples

The presence of a relationship between iron and aluminum and fish IBI scores forms the basis of eliminating biological impairment due to fish IBI scores in the draft TMDL. A quick review of the summary data in Table 1 indicates there is no relationship between aluminum concentration and IBI score or iron concentration and IBI scores, regardless of whether the form of metal is total or dissolved. Thus, a reduction in iron and aluminum would not be projected to improve fish IBI scores. For example, an IBI score of 12 is associated with a geometric mean range of 5,667 to 359 ug/L total aluminum, and a range of 2,356 to 84 ug/L for dissolved aluminum from the same sites. These concentration data almost span the full range of aluminum data presented. A similar pattern indicating no relationship between IBI score and metals concentration is shown for the summary data for iron in Table 2.

Observations from the summary data are as follows:

- Use of one result to characterize a site (Station 5) is highly problematic, particularly given the role of total suspended solids and flow on concentrations of aluminum and iron.
- The total aluminum (summarized 3 different ways to observe central tendency of data) concentrations for Stations 8, 9, 10, 11 are not distinctly different than the concentrations for the only site that is scored “poor” (Station 16).
- The total iron (summarized 3 different ways to observe central tendency of data) concentrations for Stations 8 and 9 are not distinctly different than the concentrations for the only site that is scored “poor” (Station 16).
- The dissolved aluminum data for Station 2 is greater than expected given the pH is greater than 6, based on the USGS field data. Given the dissolved aluminum varied from Non-Detect to 7,430 ug/L, field or lab contamination or ineffective field filtration could be indicated. It would have been extremely useful, given the relationship of aluminum solubility and iron solubility to pH for field pH to have been generated concurrent with sample collection.
- The dissolved aluminum data for Station 11, as compared to the two data sources for total aluminum data, appear aberrant. It is not technically possible to have greater levels of dissolved aluminum compared to total aluminum. Again, field or lab contamination or ineffective field filtration or sample bottle mis-labeling could be indicated.
- The dissolved iron data for Station 12 (only two samples) is highly questionable and the ICC will advise against using this dataset as valid and representative.

Given that Stations 8 and 9 levels (very poor) are similar to Station 16 (poor), the ‘historic’ data (both IDEM and IDNR) presented in the report does not support that aluminum and iron are the related to the fish IBI scores. If there was a definitive relationship of only these two variables to fish IBI scores, then the projection would be that Stations 8 and 9 would score as poor (IBI = 28), not very poor (IBI = 12 and 14). The data presented implicate that other factors such as habitat, hydrologic patterns, land use influences, and other water quality constituents may be significant contributors in forming the fish community structure. These other factors appear to have not been considered in the draft TMDL.

IDEM should have performed some statistical evaluation to determine whether there was a relationship or even a concordance between aluminum and / or iron data and the fish IBI scores. Of course for IDEM to have conducted this type of invaluable assessment, IDEM should have collected concurrent aluminum and iron water quality data during the USGS study and analyzed aluminum and iron at those sites where fish IBI scores spanned a wider range to include sites that included good, fair, and poor rating.

There is no data or information that provides convincing evidence that there is a relationship between aluminum and fish IBI scores or iron and fish IBI scores.

<u>Aluminum and Iron Busseron Creek Water Quality Data versus other Indiana Water Quality Data</u>

The TMDL draft does not compare the aluminum and iron concentrations monitored in the Busseron Creek watershed to other results that are available to the public. IDEM should have conducted this exercise since iron and aluminum are elements commonly found in soil and minerals. Weathering of earth minerals and stormwater run-off containing suspended solids should contain total aluminum and total iron.

By way of example, the increase in soil-related suspended solids should result in an increase in total aluminum. As presented in the 2006 draft ATSDR "Toxicology Profile for Aluminum":

> Aluminum is the most abundant metal and the third most abundant element in the earth's crust, comprising about 8.8% by weight (88 g/kg). Mean aluminum concentrations in cultivated and uncultivated soil samples collected during a number of field studies were 33 g/kg (range 7–>100 g/kg) for subsurface soils in the eastern United States. Concentrations of various elements in 541 streambed-sediment samples collected from 20 study areas in the conterminous United States (1992–1996) were analyzed as part of the National Water-Quality Assessment Program of the U.S. Geological Survey. Aluminum was present in all samples; concentrations ranged from 1.4 to 14% by weight (14–140 g/kg), with a median of 6.4% by weight.

A little soil-related suspended solid can significantly impact the total aluminum concentration, e.g., 5 mg of soil-related TSS could contribute 0.165 mg of total aluminum to the water column.

Table 3. Comparison of Total Aluminum Concentrations (in ug/L) for Indiana Waters

Location	Maximum	75th Percentile	Minimum	Geomean	Coefficient Of Variation	n
Busseron Creek Watershed	19,700	7,450	20	1,200	1.18	69
Terre Haute, Wabash River	10,700	2,925	329	1,418	1.1	39
Newburgh, Ohio River	11,600	3,452	547	2,201	1.05	10
Cannelton, Ohio River	5,470	2,698	540	1,814	0.65	10

The Wabash River data was generated by IP Terre Haute between April and November 2002 using an IDEM approved Sampling and Analysis Program. It was submitted to IDEM in 2003 as part of a NPDES Permit activity. The Ohio River data is from ORSANCO and was generated between January 2003 and July 2004.

As the sample sizes are different, a statistical comparison cannot be made but an observation would be that Terre Haute, Newburgh and the Busseron Creek geometric mean of results are similar. In addition the Coefficient of Variation (CV), an indicator of variability and distribution of data, are not that different. It should be noted that based on review of ORSANCO, Kentucky, and Indiana reports, the Ohio River shows no fish impairment even though aluminum is greater than the target presented in the TMDL draft. In addition, the Wabash River segment incorporating Terre Haute is not considered biologically impaired based on fish IBI, nor listed as having "impaired biotic communities".

Similar to aluminum, total iron is supposed to be present in ambient waters and will vary as suspended solids vary. IDEM has acknowledged this fact in NPDES permitting for stormwater dominated dischargers (e.g., AEP Tanners Creek, 2004 and ALCOA Warrick, 2005-2006). In a special study on Fall Creek conducted by IDEM reported mean results for total iron between 150 ug/L to 990 ug/L (Trace Metals Pilot Project 1998 Fall Creek Watershed Study Report). Once again, IDEM should have placed the Busseron Creek iron data in context to other Indiana waters.

Using the ORSANCO Ohio River data referenced for total aluminum, total iron data can be compared.

Table 4. Comparison of Total Iron Concentrations (in ug/L) for Indiana Waters

Location	Maximum	75th Percentile	Minimum	Geomean	Coefficient Of Variation	n
Busseron Creek Watershed	35,900	4,880	110	2,644	1.42	69
Newburgh, Ohio River	11,740	4,828	587	3,318	0.81	10
Cannelton, Ohio River	8,880	4,115	475	2,623	0.70	10

As expected, the range of iron is greater (CV) in the Busseron Creek watershed that may be attributed to land use activities as there are mines that are being reclaimed. However, the geometric mean between the Busseron Creek watershed results and the Ohio River do not appear to be different. Once again, it should be noted that the Ohio River is not reported as biologically impaired based on iron concentrations that are equivalent to Busseron Creek or based on fish IBI scores, nor has ORSANCO indicated a concern with fish diversity, abundance, and richness.

The comparison of just a few Indiana waterbodies, that would also have variable suspended solids similar to Busseron Creek waters, to the results from Busseron Creek do not indicate that the total aluminum and total iron levels are dramatically different and at levels that would presume to be the only cause of very poor and poor fish IBI scores.

Aquatic Toxicity Data for Aluminum and Iron

The TMDL draft claims that the target values shown in Table 5 are aquatic life criteria; they are not. The iron and aluminum values are not even non-rule policy guidance values as they have not been presented to the Indiana WPCB for approval. In addition, whenever IDEM has recently attempted to use these out-dated aquatic life values for development of NPDES Permit discharge limits, they have been challenged and IDEM has revised or withdrawn applying these values. Finally, given the ramifications of establishing a TMDL for iron and aluminum, common elements of minerals and soils, IDEM should have attempted to update these values by updating the toxicity databases and updating their data validation of all toxicity data.

Aluminum. Despite the reference to the IDEM 2005 update, IDEM has not updated their toxicity database for aluminum to recent studies, even in 2005. In addition, IDEM did not reference that there was a July 2005 detailed response (from ALCOA to IDEM) requesting further technical clarification of the March 2005 update; these technical clarifications have yet to be made. One of the issues that IDEM seems to be struggling with is that 40 CFR 132 Appendix F and their own regulations (327 IAC 2-1.5-11) for inside the Great Lakes Basin provide very specific guidance on the validation toxicity data prior to use of developing criteria. These regulations expand the 1985 USPEA guidance on data validation. IDEM, in applying these test acceptability criteria to their databases for aluminum, have declined to develop a Tier II aquatic life value or Tier I aquatic life criteria. This is a similar position to other Great Lakes states.

Comprehensive evaluations of the data on the toxicity of aluminum have recently been conducted by the states of New Mexico and West Virginia and the province of British Columbia. In proposed rulemaking for West Virginia, there is documentation that provides an updated toxicity database as well as an evaluation of the validity of historic, as well as recent, aluminum toxicity studies. USEPA approved (January 2006) West Virginia's use of 750 ug/L dissolved aluminum as an applicable chronic aquatic criteria for non-trout waters.

Using an expanded valid aquatic toxicity database for aluminum, ICC provides the following comparison built from Table 1:

Table 5. Comparison of Mean Aluminum Measurements to Published Literature Toxicity Values

Station #	Fish IBI Score (1)	(2)	Parameter	Geo-mean (ug/L)	IDEM 2005 memo - Chronic	Published Data- ChV **Fish (3)**	Most Sensitive Spp.- Invertebrates, ChV	Published Data - LC50 **Fish (4)**
2	12	vp	Aluminum, Total	5,667		7,350	1,908	35,000 to >59,100
5	20	vp	Aluminum, Total	3,692		7,350	1,908	35,000 to >59,100
8	14	vp	Aluminum	301		7,350	1,908	35,000 to >59,100
9	12	vp	Aluminum, Total	359		7,350	1,908	35,000 to >59,100
11	16	vp	Aluminum, Total	946		7,350	1,908	35,000 to >59,100
11	16	vp	Aluminum	214		7,350	1,908	35,000 to >59,100
12	18	vp	Aluminum, Total	1,098		7,350	1,908	35,000 to >59,100
16	28	p	Aluminum, Total	409		7,350	1,908	35,000 to >59,100
2	12	vp	Aluminum, Dissolved	2,356	174			>1,300
5	20	vp	Aluminum, Dissolved	47	174			>1,300
9	12	vp	Aluminum, Dissolved	84	174			>1,300
11	16	vp	Aluminum, Dissolved	415	174			>1,300

1. Field Work occurred Sept 17 through Sept 19, 2007
2. vp = very poor; p= poor
3. Validated studies, for warmwater 'occur at the site' species. ChV = Chronic Value based on most sensitive species.
4. Validated studies, range for warmwater 'occur at the site' species. LC50 = Lethal Concentration to 50% test organisms, therefore acute response.

Observations from the presentation of the chronic values (reflecting sublethal responses like reproduction and growth) and acute values (reflecting mortality):

- Based on updated toxicity studies as well as the IDEM March 2005 document, the most sensitive species to aluminum, whether as total or dissolved, are aquatic invertebrates and not vertebrates such as fish. The toxicity data indicate that a reduction in aluminum from the concentrations measured in Busseron Creek would not be expected to improve fish IBI scores.
- The IDEM Chronic Aquatic Life concentration is based on the intent of deriving a 4-day average concentration to protect 95 percent of the species 95 percent of the time [not to be exceeded once every 3 years]. It is not indicative of the tolerance level of a chemical to specific species that occur at a site, it is not indicative of 'cause and effect'.
- The chronic value for total aluminum would not indicate that fish would be impacted by the total aluminum geometric means for the Busseron Creek Stations, even though fish IBI are very poor and one is poor. Use of a chronic value (geometric mean of the LOEC and NOEC concentration for the most sensitive sublethal endpoint) for a specific species allows for a better framework to discern 'cause and effect'.
- The LC50 range for total aluminum would not indicate that total aluminum geometric means for the Busseron Creek Stations are causing fish mortality.
- The toxicity data for dissolved aluminum would not indicate that dissolved aluminum geometric means for the Busseron Creek Stations are causing fish mortality.
- Using the technically flawed 2005 IDEM aquatic life chronic concentration, which is presented in the form of dissolved aluminum, the geometric mean of dissolved aluminum for Stations 5 and 9 are well below this value. As mentioned earlier, the dissolved data for Stations 2 and 11 appear to contain questionable results. Specific to Station 11, of the 10 results, nine (9) are well below 174 ug/L.
- It would have been extremely useful, given the relationship of aluminum solubility and bioavailability of aluminum to pH for field pH to have been generated concurrent with sample collection.

Iron. The IDEM memorandum issued in 1997 was not based on a complete reference list of studies on the aquatic toxicity of iron, in addition the studies that were presented did not undergo data validation and assessment of acceptability, and finally IDEM mixed the toxicity results for iron(+2), ferrous and iron(+3), ferric in developing a database for iron. It is commonly accepted that the species of iron most toxic to aquatic life is ferrous iron, not ferric.

IDEM has received significant comments from discharges when IDEM attempted to implement the technically flawed 1997 memorandum on iron into NPDES permits (e.g., ALCOA Warrick, ALCOA Lafayette, USS Gary, AEP Tanners Creek) and IDEM did not move forward with limits or conditions using this 1997 memorandum. In addition, IDEM, for inside the Great Lakes, as required by Indiana regulations about species and form of metal and data validity, has not presented a Tier II aquatic life value. This is a similar position as other Great Lakes states.

The ICC is confounded by the level of confidence the TMDL draft places on this antiquated 1997 memorandum. According to the logic of the TMDL draft, the Ohio River should have impaired fish communities based on the IDEM 1997 iron aquatic life value of 2,495 ug/L.

There are at least two references that have more completely evaluated the studies on iron toxicity: "Water Quality Criteria Development for Iron – Technical Report", December 2004 EPRI, Palo Alto, CA and "Ambient Water Quality Guidelines for Iron", February 2008, MOE, Province of British Columbia. Using the updated and validated data from these documents, ICC presents a comparison iron built from Table 2 (and continuing IDEM's approach of not distinguishing between ferrous and ferric as analytically IDEM did not measure the different species):

Table 6. Comparison of Mean Iron Measurements to Published Literature Toxicity Values

Station #	Fish IBI Score (1)	(2)	Parameter	Geomean (ug/L)	IDEM 1997 memo - Chronic	Published Data-ChV **Fish (3)**	Most Sensitive Spp.- Invertebrates, ChV	Published Data - LC50 **Fish (4)**
2	12	vp	Iron, Total	4,294	2,495		1,740	
5	20	vp	Iron, Total	3,109	2,495		1,740	
8	14	vp	Iron	1,055	2,495		1,740	
9	12	vp	Iron, Total	875	2,495		1,740	
11	16	vp	Iron, Total	1,664	2,495		1,740	
11	16	vp	Iron	2,582	2,495		1,740	
12	18	vp	Iron, Total	5,427	2,495		1,740	
16	28	p	Iron, Total	548	2,495		1,740	
2	12	vp	Iron, Dissolved	517	2,495	693 to > 10,230		2,086 - 105,500
5	20	vp	Iron, Dissolved	108	2,495	693 to > 10,230		2,086 - 105,500
9	12	vp	Iron, Dissolved	159	2,495	693 to > 10,230		2,086 - 105,500
11	16	vp	Iron, Dissolved	961	2,495	693 to > 10,230		2,086 - 105,500

1. Field Work occurred Sept 17 through Sept 19, 2007
2. vp = very poor; p= poor
3. Validated studies, for warmwater 'occur at the site' species. ChV = Chronic Value based on most sensitive species.
4. Validated studies, range for warmwater 'occur at the site' species. LC50 = Lethal Concentration to 50% test organisms, therefore acute response.

Observations from the presentation of the chronic values (reflecting sublethal responses like reproduction and growth) and acute values (reflecting mortality):

- The pH during the fish collection for the above stations was between pH 6.9 to 8.4. The Dissolved Oxygen was between 4.5 mg/L to 10.9 mg/L. Based on these pH and DO readings, it is logical to project that the predominant form of iron present would be ferric or iron(+3).

- Based on updated toxicity studies as well as the IDEM 1997 document, the most sensitive species to iron, whether as total (mainly ferric) or dissolved (mainly ferrous), are aquatic invertebrates not vertebrates such as fish. The toxicity data indicate that a reduction in iron from the concentrations measured in Busseron Creek would not be expected to improve fish IBI scores.
- The IDEM Chronic Aquatic Life concentration is based on the intent of deriving a 4-day average concentration to protect 95 percent of the species 95 percent of the time [not to be exceeded once every 3 years]. It is not indicative of the tolerance level of a chemical to specific species that occur at a site, it is not indicative of 'cause and effect'.
- The chronic value for dissolved iron would not indicate that fish would be impacted by the dissolved iron geometric means for the Busseron Creek Stations, even though fish IBI are very poor and one is poor. Use of a chronic value (geometric mean of the LOEC and NOEC concentration for the most sensitive sublethal endpoint) for a specific species allows for a better framework to discern 'cause and effect'.
- The LC50 range for dissolved iron would not indicate that dissolved iron geometric means for the Busseron Creek Stations are causing fish mortality.
- It would be have been extremely useful, given the relationship of iron speciation and iron aquatic toxicity to pH, DO, and redox potential, if field pH, DO, and redox were generated concurrent with sample collection.

Based on use of updated published aquatic toxicity data for aluminum and iron, use of the chronic value (ChV) for species that occur in Busseron Creek, and comparing the appropriate forms (dissolved or total), there is no indication that aluminum, either as total or dissolved (barring Stations 2 and 11 aberrant data), or iron are the chemicals causing the low fish IBI scores.

IDEM, before finalizing the TMDL for Busseron Creek, must:

- Update the toxicity databases for aluminum and iron;
- Update the process for validating data from aquatic toxicity references;
- Clarify if the aquatic toxicity databases address total or dissolved aluminum, the relationship to pH, iron(+2) or iron(+3);
- Given the lack of complete species databases and the concern with fish IBI, use ChV for the species that occur in the Busseron Creek watershed and not use FCV or CAC; and
- If IDEM continue to focus on fish IBI score as the biological metric to indicate biological impairment, then IDEM must make a concerted effort to evaluate other factors that commonly influence fish IBI scores (includes water quality constituents, riparian and instream habitat, land use practices, and hydrologic patterns).

In general, it would be beneficial to being able to focus on appropriate components potentially impacting the Busseron Creek watershed if IDEM designed their programs to generate data concurrently. For example, if the fish population is of most concern, then collect data on water quantity (velocities, flow), habitat, and for the chemicals of concern, those parameters that allow assessment of bioavailability (e.g., pH, DO, redox, DOC, in addition to hardness and cations/anions).

Other issues of concern with the draft TMDL involve expressions of the Waste Load Allocations (WLA) values of 0 (zero). Revisions of the draft TMDL incorporate language that implies a WLA of zero

> "…does not prohibit future permitted facilities from discharging to the segment. The WLA for any new discharger to the impaired segment will be calculated using the WQS or Target for the parameters, as necessary. The TMDL will be modified as needed to account for any allocation changes in the impaired segments."

IDEM must include additional explanation and technical discussion on the methodology of how the TMDL will be modified as needed to account for any allocation changes. At a minimum, a discussion of "as needed" should be included along with a description of what steps will be taken to determine the revised WLA.

The use of a surrogate watershed for determination of the hydrologic condition of the Busseron Creek Watershed for TMDL modeling purposes without ground truth calibration within the Busseron Creek Watershed continues to be of concern. IDEM has presented statements that the U.S. Geological Survey's (USGS) National Water Information System (NWIS) database was checked and determined that both gauges 03342100 and 03342500 have sufficient flow. In addition, the flow record from these gauges can therefore be used to approximate flows at the various monitoring sites in the Busseron Creek watershed using an area-weighted approach (i.e., flows at the individual monitoring sites are assumed proportionate to flows at the gauge and adjusted to account for drainage area). They continue to state: "The relative error for the load duration analysis will be evaluated by comparing the predicted flows to the available (limited) observed flows. A target error of less than 10 percent is the proposed tolerance limit."
In a response to questions regarding calibration of the model to actual Busseron Creek flows and determination of relative error, IDEM states "No additional flow data was found for this watershed, therefore it was unnecessary to calculate relative error. The QAPP contained language that gave the option to calculate relative error if and only if additional data was found." More detailed explanation should be provided in the draft TMDL of how a lack of additional flow data (i.e., spot checking flow status at various locations in the watershed to see if it matches the surrogate model for site-specific calibration purposes) negates the need to estimate relative error for the load duration analysis. The load duration analysis is crucial to the determination of WLA, the load allocation, and the overall TMDL plan. While a lack of flow data may prevent the ability to calculate relative error, it does not eliminate the potential for relative error to exist.